2012 NASA Cost Estimating Handbook Highlights

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CEH Presentation Outline

- CEH Overview
- Contributors
- CAD Vision
- CEH Outline
  - Main Body
  - Appendices
- Future Actions

CEH Overview - Timeline

Criteria	2002	2004	2008	2012
Description	7 chapters 19 appendices	6 chapters 32 appendices	6 volumes	4 chapters 15 appendices
Total Pages **- Document** **- Appendices**	196 82 114	348 167 181	342 342 0	≈210 35 175
Intended Audience	Cost Estimating Community	Cost Estimating Community	Cost Estimating Community	Cost Estimating Community, Prog/Proj Mgrs
Source of Content	NASA, DOD agencies, prof societies, industry	NASA, DOD agencies, prof societies, industry	NASA, DOD agencies, prof societies, industry	NASA Centers; previous handbooks, DOD agencies, prof societies, industry
Editor	BAH	BAH	BAH	NASA-JPL
Concerns	More depth needed for cost estimating topics	Too large and difficult to digest	Difficult to locate information; used different mgmt approach (not CRM)	JCL Handbook will be needed

CEH Overview

- The major goal is to ensure that appropriate policy is adopted and that best practices are being developed, communicated, and used across the Agency.
  - Accomplished by engaging the NASA Cost Estimating Community representatives in the update.
- Scheduled to be complete by the end of FY 2012.
- Document has been through 3 detailed reviews across NASA.
  - All significant comments have been addressed.
  - Sample examples have been added where appropriate.
  - The Handbook is waiting to go to the NASA publication group for final publication.

CEH Primary Contributors

- Jo Gunderson (Contracting Officer)
- Tom Coonce (Former CAD)
- Leigh Rosenberg (Task Lead)
- Sherry Stukes
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- Vision Analytics, Inc.

Additional CEH Contributors

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- Arlene Moore
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- Stephen Shinn
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CAD Vision

CEH consists of two parts:

1. Summary document that gives an overview of the cost estimating culture. It contains information that enables a project manager (or someone not very familiar with cost estimating such as a new hire) to obtain an understanding of the cost estimate/schedule that the staff or contractors will be providing for a particular project.
2. Appendices provide the steps for performing supportable, defendable, high quality cost estimates. They also provide sample examples to illustrate the individual elements of a cost estimate.

CEH Outline – Main Body

1 Introduction

2 Cost Estimating Process

2.1 Understand Customer Needs
2.1.1 Acquisition Life Cycle
2.1.2 Potential Uses for Cost Estimates and Analyses
2.2 Develop the Baseline Estimate
2.2.1 Define Scope/Objectives
2.2.2 Define Estimating Structure
2.2.3 Obtain and Normalize Data
2.2.4 Establish Estimating Ground Rules and Assumptions (GR&As)
2.2.5 Select Approach and Develop Estimate
2.2.6 Perform Cross-Check
2.3 Develop Probabilistic Cost Estimate
2.3.1 Why Point Estimates are Wrong or Why do Probabilistic Analysis?
2.3.2 Cost Risk is a Part of the Estimating Process
2.3.3 Probabilistic Cost and Schedule Estimates at KDP-B
2.3.4 Developing a JCL for KDP-C
2.4 Document and Communicate the Results
2.4.1 Document the Estimate
2.4.2 Communicate the Estimate

3 Economic Analysis for Making Decisions of Choice

3.1 Trade Studies
3.1.1 Trade Study Analysis
3.1.2 Make vs Buy Analysis
3.1.3 Lease vs Buy Analysis
3.2 Business Case Analysis
3.2.1 Business Case Analysis
3.2.2 Present Value
3.2.3 Net Present Value
3.2.4 Return on Investment
3.3 Cost As an Independent Variable
3.4 Affordability

4 Analytical Support Data Sets

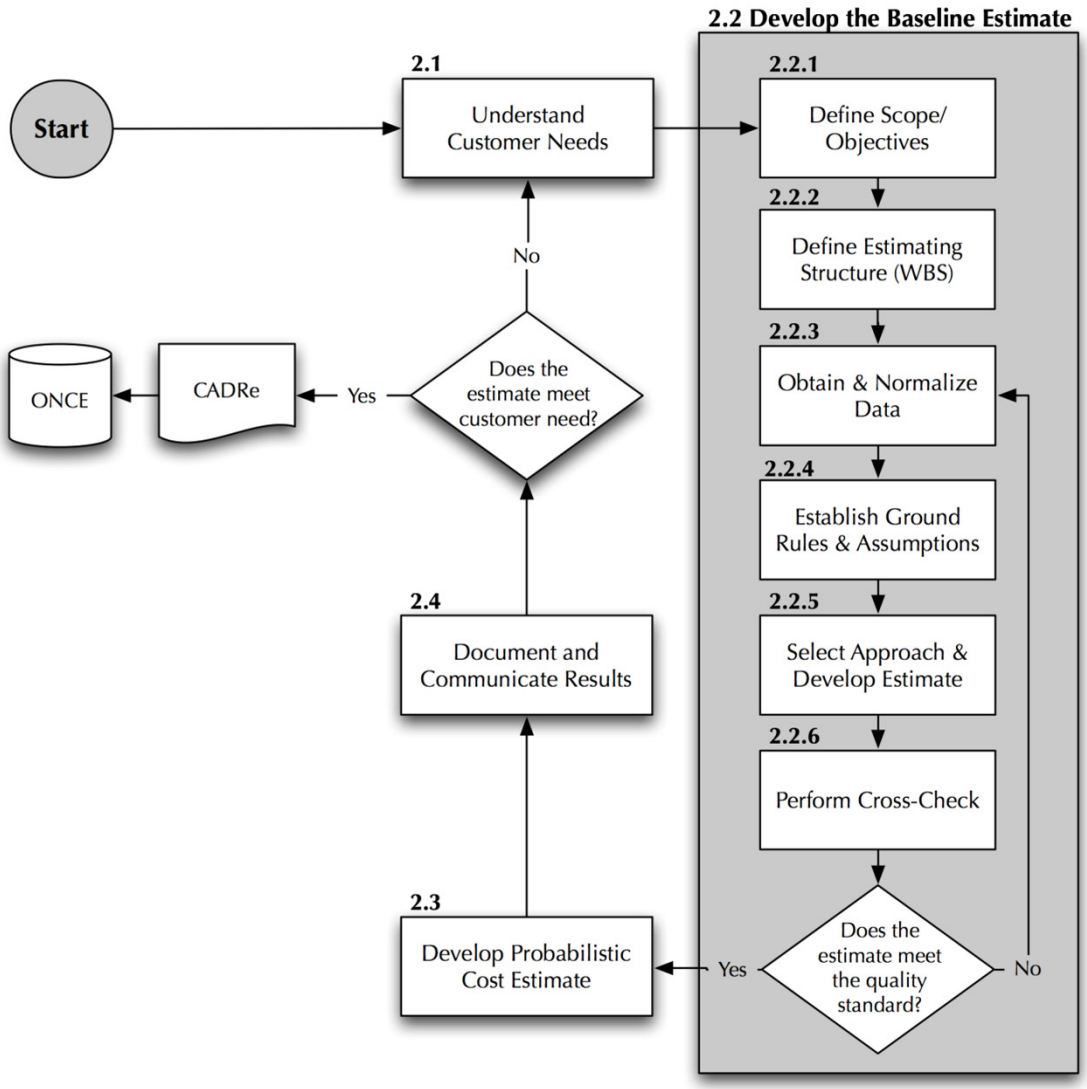
4.1 CADRe Overview
4.2 ONCE Overview

1 – Introduction

- Revision Highlights
  - Difference in organization and philosophy
  - Addition of new topics such as JCL
- Handbook Usage
  - Electronically available
  - Feedback and suggestions being collected
- Introduction for the Estimator
  - Different usages for various audiences
  - Addresses new estimating requirements
  - Format follows the NASA cost estimating process

Cost Estimating Process

Iterative Cost Estimating Process



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2 – Cost Estimating Process

- Six-step process
  - Contains traditional estimating activities
  - Iterative process
- Source references identified with the text
- Illustrative Tables and Figures provided
  - Summarizes main content
  - Examples added where appropriate
  - May be used as a quick reference

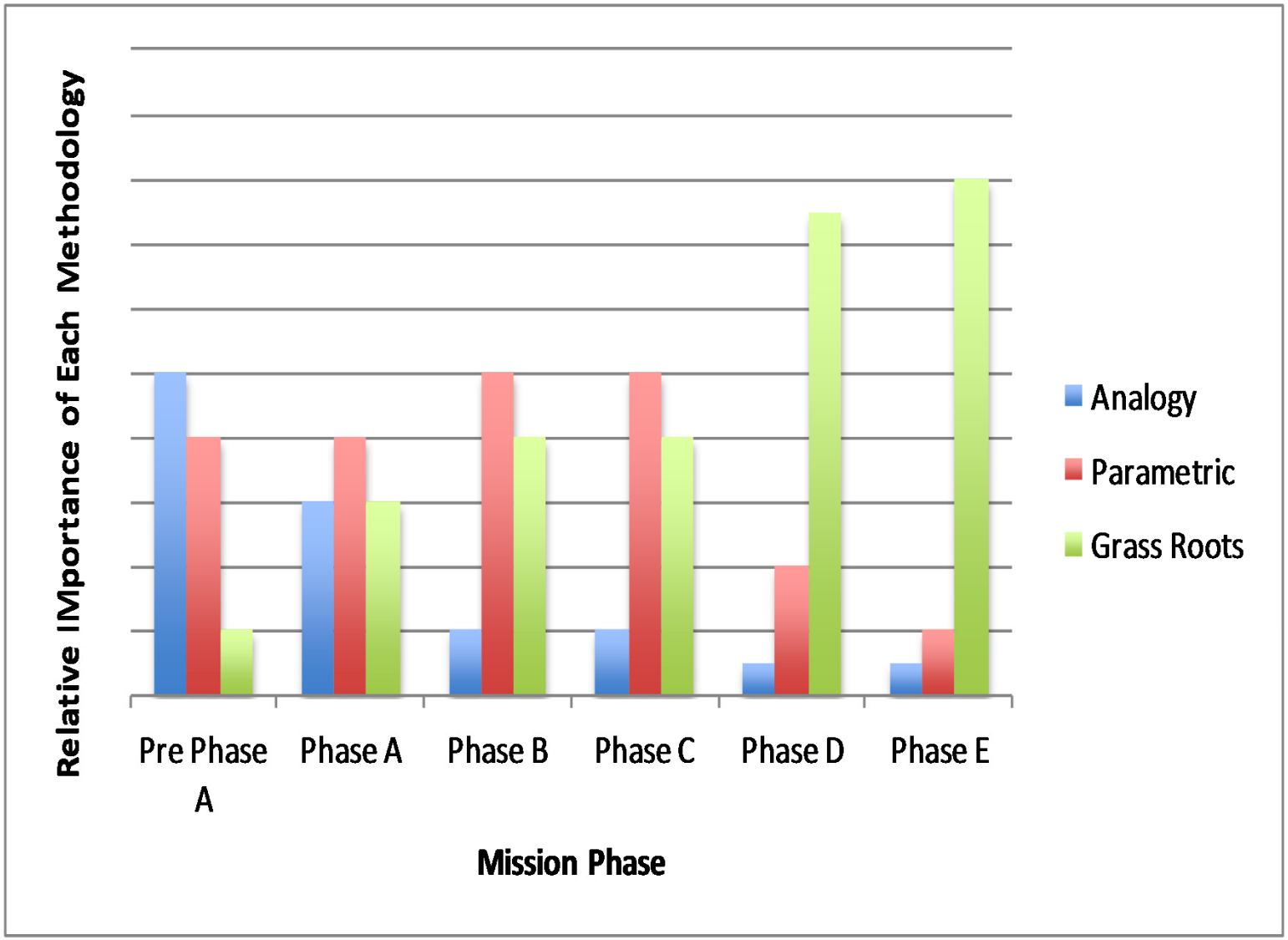
Example Table

Table 3. Strengths and Weaknesses of Cost Estimating Methods

Method	Strength	Weakness	Application
Analogy	• Requires little data • Based on actual data • Reasonably quick • Good audit trail	• Subjective adjustments • Accuracy depends on similarity of items • Difficult to assess effect of design change • Blind to cost drivers	• Use early in the design process when few data are available • Rough order-of-magnitude estimate • Can be used as a cross-check on other methods
Parametric	• Reasonably quick • Encourages discipline • Good audit trail • Repeatable process • Cost driver visibility • Incorporates real-world effects (funding, technical, risk)	• May lack detail • Frequently incompatibile output • Model investment • Cultural barrier • Difficulty communicating to customer	• Design-to-cost trade studies • Can be used as a cross-check • Usually required for Announcement of Opportunity (AO) proposals
Grassroots	• Easily audited • Sensitive to labor rates • Tracks vendor quotes • Time honored • Flexible output format • Helps proposal team visualize requirements	• Requires detailed design • Slow and laborious • Cumbersome • Can be overly optimistic	• Production estimating • Software development • Negotiations

Based on ©MCR LLC, "Cost Estimating: The Starting Point of EVM"

Example Figure



3 – Decisions of Choice

- Tools and techniques to aide estimators in making informed decisions
- Topic definitions provided
  - Adapted to NASA usage
  - Relationship to related topics identified
- Details provided in Appendix M
  - Examples
  - References
  - Paragraph numbering in Appendix consistent with the main body

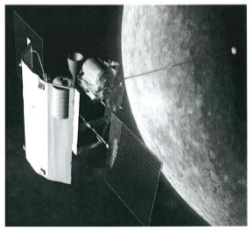
4 – Support Data Sets*

- CADRe
  - 3-part compilation of data
  - Collected at major milestones
  - Reviewed and approved by the project
  - Available on NSCKN CADRe CoP
- ONCE
  - Convenient framework for locating data of interest
  - Web-based interface
  - Easy to use

**Details will be discussed in subsequent presentation by Eric Plumer*

CADRe

MErcury Surface, Space ENvironment GEochemistry and Ranging Mission (MESSENGER)



Cost Analysis Documentation of Requirements (CADRe) at Launch (8/3/2004)

Revision as of August 2007

Prepared by: Nathan Menton 9/17/07 Date Cost Engineer	Reviewed by: Date Project System Engineer
Prepared by Date Cost Engineer	Reviewed by: Date Project Business Manager
Reviewed by: Sept. 7 2007 Date Supervisor, Cost Engineering Group	Approved by: 2/21/08 Date Project Manager

Part A contains general descriptive information about the project.

Flight System Systems Engineering	3			
Flight System Product Assurance	3			
Spacecraft	3	17,176	10,273	42,241
Spacecraft Management	4			
Spacecraft Systems Engineering	4			
Spacecraft Product Assurance	4	35	-	170
Spacecraft Structures & Mechanisms Total	4	1,371	934	4,293
Spacecraft Thermal Control	4	457	69	847
Spacecraft Electrical Power & Distribution	4	2,681	1,092	10,656
Spacecraft GN&C	4	1,147	895	3,586
Spacecraft Propulsion	4	5,201	3,492	5,021
Spacecraft Communications	4	3,529	1,534	7,251
Spacecraft C&DH	4	1,420	1,558	5,939
Spacecraft Software	4	1,335	699	4,479
Entry/Decent/Lander	3			
Spacecraft Retirement & Disposal	3			
Launch Vehicle/Services	2	-	5,600	24,000
Mission Operations System (MOS)	2	-	-	-
Ground Data System (GDS)	2	964	1,232	5,543
System Integration, Assembly, Test & Check Out	2	290	183	1,190
Education & Public Outreach	2	4	5	21

ıICAL PARAMETERS

WBS Name	Component	Value
	Human Rated	No
	Destination	Earth Trailing Orbit
	Type of Craft	Orbiter
	Launch Date	December 2010
	Average Payload Power	4.5 kW
	GN&C Method	3-axis Stabilization
	Pointing Accuracy	
	Pointing Knowledge	
	Slew Rate	
	Data Storage	512 Gb
	Number of Instruments	1
	Downlink Mode	X/Ka-band
	Downlink Data Rate	10 Mbps
	Uplink Mode	X-band
	Uplink Data Rate	2 kbps
	Launch Vehicle	Atlas V 551
Structures & Mechanisms	Load Carrying Shell/Truss Material	Graphite
	HGA Assembly Material	Graphite
Thermal Control	Insulation Type	MLI
	Conductive Structures Material	Annealed Pyrolytic Graphite
Electrical Power & Distribution	Solar Cell Type	ATJ GaAs
	Solar Array Output, EOL	6 kW
	Battery Type	NiH2
	Battery Power Output	64 A-hr
Guidance, Navigation & Control	Reaction Wheel Torque	0.14 Nm
Propulsion Subsystem	Monopropellant Thrusters Thrust	4.45 N
	Propellant Type	Hydrazine
Telecommunications Subsystem	Transmit Bands	X/Ka-band
	Patch Antenna	X-band
	Horn Antenna	X/Ka-band
C&DH Subsystem	Solid State Recorder Memory Size	512 Gb

Part B contains hardware and software technical parameters that should be necessary to estimate the project's life cycle cost with typical parametric cost models.

Part C contains the project's life cycle cost estimate (LCC). This section represents the project's cost estimate and the project manager is responsible for approving the inputs from the various participants including full cost elements and submitting an integrated cost estimate.

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CEH Outline - Appendices

Appendix	Title
A	References
B	Acronyms
C	Glossary
D	Work Breakdown Structure
E	Joint Confidence Levels
F	Cost Estimating Methodologies
G	Schedule Estimating Relationships
H	Phasing of Cost Estimates
I	Technology Cost Estimating
J	Risk Methodologies
K	Document and Communicate the Results
L	Using Performance Information to Estimate
M	Decisions of Choice
N	Models and Tools
O	Cost of Facilities and Ground Support Equipment Cost Assessment

CEH Appendices

- Resources
  - Reference listing
  - Acronyms
  - Glossary of terms
- “How To” provided for core estimating topics
- Summary of Estimating tools
- JCL to be added in the future

Future Actions

- Respond to residual comments
  - NASA HQ staff
  - ECASG members
- Support HQ Documentarian
- Coordinate posting/distribution of Handbook
- Publication expected September 2012
- Populate placeholder Appendix
  - Joint Confidence Level